APPLICATION FOR UNITED STATES LETTERS PATENT

AIR-CONDITIONING SYSTEM FOR ROOMS

BE-124

BACKGROUND OF THE INVENTION

The invention relates to and air-conditioning system for rooms.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an air-conditioning system for rooms, in particular, for living spaces, that operates effectively and can be installed cost-efficiently.

In accordance with the present invention, this is achieved in that a flat cooling element is arranged within a wall of the room.

Advantageously, such a cooling element, through which preferably a cooling medium flows, can be installed with relatively minimal additional expenditure in the walls of the room, for example, during construction of the building. Without taking up any of the useable space of the room, it is possible in this way to provide large cooling-effective surfaces in rooms.

For installing the cooling elements, the ceiling is particularly suitable. In this case, the rising hot air and the cold air dropping from the cool ceiling cause advantageously an intensive air circulation that is beneficial for air conditioning the room.

Expediently, the cooling element is embedded in the wall material near the surface of the wall. In a preferred embodiment of the invention, the cooling element is embedded in the plaster layer of the wall. For this purpose, a cooling element is particularly beneficial that is comprised of at least one pre-manufactured web of a flexible carrier mat and at least one flexible cooling pipe fastened on the carrier mat. For a pipe diameter of less than 6 mm and a mat thickness of less than 1 mm, such a cooling system can be positioned without problems within the plaster layer whose thickness is within the normal or conventional range of such layers.

Preferably, the carrier mat has penetrations like a screen and has in particular a net structure. Such a mat that is formed by a fabric or woven material or mesh is penetrated by the plaster material, and, in this way, a fixed connection can be realized between the plaster material and the base onto which the plaster is applied. Advantageously, the mat enhances, on the one hand, the attachment of the plaster on the base surface to which the plaster is applied while forming, on the other hand, a reinforcement that strengthens the plaster layer.

On the side that is facing away from the base to which the plaster is applied, the mat can be provided with projecting pin-shaped connecting elements that are preferably undercut and therefore can get hooked within the plaster.

In another embodiment of the invention, the cooling element is designed to be adhesively connected to or/and attached (tacked) to the base to which the plaster is applied or/and a precoat of plaster.

The cooling element, in particular, the carrier mat, can be pre-manufactured to be self-adhesive in that it is provided with an adhesive layer that is preferably covered by a protective film that can be removed on site. In this way, self-adhesive webs can be manufactured that are preferably wound to a roll and are removed or unwound from the roll for adhesively connecting them to the base to which the plaster is to be applied. At the ends of the ceiling, the carrier mat is simply cut and, optionally, a further web section is rolled out in the opposite direction wherein the flexible cooling pipe can be continued from web section to web section.

The attachment that is provided in addition to or as an alternative to the adhesive connection can be realized by nailing, wherein, for example, staple-shaped or bracket-shaped nail elements are shot by means of a staple gun or the like through the carrier mat into the base onto which the plaster is to be applied or into the precoat of plaster.

On the aforementioned web or carrier mat, two cooling pipes, for example, can be arranged parallel to one another wherein the cooling medium flows through the cooling pipes in opposite directions and wherein each cooling pipe is connected to a cooling medium supply and a cooling medium return. Because of the opposite flow of the cooling medium, a uniform heat removal is realized across the surface area of the cooling element.

The installation of further cooling pipes is possible. In particular in this case, it appears to be expedient to arrange the cooling pipes parallel and at a spacing to one another in order to enable at locations between the pipes a bonding of the plaster to the base to which it is to be applied and to provide in this way a stable plaster layer.

Cooling elements of several rooms can be connected by means of supply and return pipes installed within the building walls to a central cooling aggregate. The new cooling system according to the invention that enables the formation of large cooling surfaces also enables however the use of cooling energy reservoirs whose temperatures are only slightly below the desired target temperature of the room. The cooling energy reservoir can be, for example, a well or a flowing stream having a temperature of 20°. Also, the connection of the cooling element with a heat exchanger that is arranged in the ground is possible.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

Fig. 1 shows a cooling element for use in an air-conditioning system according to the invention;

Fig. 2 shows detail A of the cooling element of Fig. 1;

Fig. 3 is an illustration for explaining the installation of a cooling element according to Figs. 1 and 2;

Fig. 4 shows a partial view of the cooling element of Fig. 1 embedded in a plaster layer of a ceiling of a room; and

Fig. 5 is a schematic overall view of an air-conditioning system of a room according to the invention with cooling elements according to Figs. 1 through 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The cooling element 1 illustrated in Fig. 1 has two pre-manufactured webs 2, 3 that adjoin one another in the longitudinal direction. As shown in the detailed view of Fig. 2, the webs 2 and 3 are comprised of a carrier mat 4 of fabric or woven material having crossing threads or strands of plastic material; in the illustrated embodiment, a PVC-coated (PVC = polyvinyl chloride) glass mesh or fabric is used. For a mesh width of approximately 5 mm, the total thickness of the mat is approximately 1 mm.

On the flexible fabric carrier mat 4, two cooling pipes 5, 6 made of polyethylene are fastened by means of loops 7; they extend continuously across both carrier webs parallel to one another. They rest against one another along a surface line. In the illustrated embodiment, the outer diameter of the pipe is 6 mm while the inner diameter is 4 mm.

As indicated in Fig. 1 by arrows and illustrated in Fig. 5, one end of the pipe 5 is connected to the cooling medium supply 15 and a neighboring end of the cooling pipe 6 is connected to the cooling medium return 16. To the cooling medium return 16 the other end of the cooling pipe 5 that

neighbors the end of the cooling pipe 6 in communication with the cooling medium supply 15 is connected also. Accordingly, the cooling medium element 1 has two cooling circuits formed by the pipes 5 and 6 through which the cooling medium flows in opposite directions.

The carrier webs 2, 3 of Fig. 3 are rolled or unwound from a pre-manufactured roll 8 and are glued by an adhesive layer (not illustrated) that is produced during manufacturing on the carrier web 4 of fabric to the not yet plastered surface of a ceiling 9 that is formed, for example, by a structural concrete member. The adhesive connection is realized by applying pressure forces in accordance with the arrows 10 in a way similar to applying wallpaper. During the process of producing the adhesive connection, another worker can roll the roll 8 across the ceiling 9 for removing the web 2, 3 while removing at the same time a protective layer 11 covering the aforementioned adhesive layer.

In deviation from the illustrated embodiment, instead of pre-manufacturing a self-adhesive web, a carrier mat of fabric could be coated with an adhesive or glue on site like a web of wallpaper. As an alternative or in addition thereto, an

adhesive material could also be applied to the not yet plastered ceiling as indicated by the arrows 19.

In the illustrated embodiment according to Fig. 1, for forming the webs or web sections 2 and 3, the carrier mat 4 is cut, but the pipes 5, 6 are guided without being cut or separated to the next web section.

In deviation from the afore described method, the webs 2 and 3, before being adhesively connected to the ceiling 9, could be rolled out until they have the required length. In this case, the pipes 5, 6 would have to be connected by means of connecting members to one another at the separating locations between the webs.

The cooling element 1 that is adhesively connected to the ceiling 9 and is comprised of two webs 2, 3 is embedded according to Fig. 4 in a plaster layer 12. The plaster layer 12 passes at an upper room corner 13 into the plaster layer 21 of a wall 14 of the room.

According to Fig. 5, several cooling elements 1', 1'' etc. can be connected to a cooling medium supply 15 and a cooling medium return 16, wherein the supply is connected to a cooling energy reservoir 18 by a pump 17 that circulates the cooling medium.

While specific embodiments of the invention have been shown and described in detail to illustrate the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.